

REMARKS

Claims 1, and 4-8 are rejected by the Examiner under 35 USC 103(a) as being unpatentable over Zhang, U.S. Patent 5,757,392 in view of Yasutomi, JP 410235860A. Also, claim 3 has been rejected by the Examiner under 35 USC 103(a) as being unpatentable over Zhang and Yasutomi as applied to claim 1 and further in view of Niikawa et al., U.S. Patent 4,866,326. These rejections are respectfully traversed.

The present invention is directed to a method and device of controlling an ink jet printhead containing a substantially closed duct in which ink is situated, said duct having at least one exit opening for the ink, which comprises setting a required pressure change for obtaining an ink drop ejection in which the drop has a previously known size and/or speed, applying an actuation pulse to an electromechanical transducer so that the pressure in the duct changes, measuring the electrical impedance of the electromechanical transducer, real time, during the application of said pulse and real time adapting the same actuation pulse on the basis of the measured impedance to obtain the said required pressure change, thus ejecting an ink drop having the previously known size and/or speed from the exit opening.

As the Examiner will note, claims 1 and 7 have been amended based on the last three lines of paragraph [0004] as well as paragraph [0009], lines 11, 12 in combination with paragraph [0010], the last two lines (that is, the actuation pulse can be updated to give the finally required pressure ejection). It is believed that newly amended claim 1 overcomes the objections raised by the Examiner in his Office Action letter.

The Zhang reference, U.S. Patent 5,757,392 teaches an actuation pulse that is divided in a pulse Pp for actually causing a pressure change for obtaining an ink drop ejection, and a separate pulse Pc for damping the pressure in the ducts. It is not until after the pulse Pp is applied that the residual pressure is measured, so that a correct pulse Pc can be calculated for optimal negating this residual pressure. Please see in this regard Col. 7, lines 60-67 of the Zhang reference where it is recited that residual pressure fluctuations in the pressure change 10 generated after application of a print voltage pulse Pp applied pressure to the piezoelectric element 16. The piezoelectric effect causes the piezoelectric element 16 to generate an electrical

signal VS in response to this pressure. The detection circuit 32 including, for example, a voltage follower OP amp 42 as shown in Fig. 5 detects the electric signal VS and outputs a detection signal SV identical to the electric signal VS to the calculation circuit 34. Indeed, this known method may be well suited for quickly negating residual pressure, but it has a very important disadvantage. Having regard of the pulse PP that leads to the actual drop ejection process, it is not until after this pulse that a measurement of the pressure in the pressure chamber will be made. The Zhang method is directed to compensating any unwanted residual effects before applying a new pressure pulse. The pulse PP itself cannot be adjusted while it is being applied. Therefore, the actual obtained pressure change when applying pulse PP is an outcome and, as such is subjected to various features that cannot be 100% controlled, such as wear, cross-talk, and the like. Since the pressure change itself is an outcome, so also is the resulting drop ejection process. Therefore, when applying the Zhang method, the size and/or speed of an ejected droplet cannot be controlled to be the same as a desired size and/or speed, as in the case of the present invention. Thus, the Applicants have overcome this drawback by providing a method wherein the measurement of the pulse takes place also during application of that part of the pulse that should lead to the required pressure change for obtaining an ink drop ejection process in which the drop has the previously known size and/or speed. Thus, even during the application of this part of the pulse itself, it can be adjusted to lead to the required pressure change and thus the required size and/or speed for the ink droplet. Accordingly, the method and device of the present invention have the same possibilities as the Zhang method, that is to be able to correct unwanted residual effects after an ink droplet has been ejected from the pressure chamber, but has the very important additional advantage that the ink droplet ejection process and device can be adjusted, real time, so as to provide droplets with required size and/or speed whereas in the Zhang method this is an outcome which has to be accepted as it is.

Because of the deficiencies in the Zhang patent, the Examiner has further relied upon the Yasutomi reference and the Niikawa et al. reference in an attempt to suggest the present invention. However, since neither of these references fill the deficiencies in the Zhang patent as pointed out here-in-above, the further reliance upon these references in an attempt to reject the

claims of the present application cannot possibly suggest the present invention. Accordingly, in view of the above amendments and remarks reconsideration of the rejections and allowance of all of the claims of the present application are respectfully requested. In the event the proposed Amendment does not place the present application into condition for allowance, entry thereof is respectfully requested as placing the present application into better condition for appeal.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Joseph A. Kolasch Reg. No. 22,463 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

By 
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